Information on Postgraduate Research Scholarship - Ref: Eng-PhD-21-25

Faculty:	Engineering and Science	**Department:**	School of Engineering
Lead Supervisor:	Dr Mahdi Salimi & Dr Yehdego Habtay		
Project Title:	Next-Generation AI-Assisted Capacitive Wireless Charging Platform for Dynamic and Universal Electric Mobility		
Project Description: (maximum 500 words)	**Aim:** This PhD-project aims to develop a next-generation, AI-assisted capacitive wireless charging (C-WPT) system for dynamic and universal electric-vehicle (EV) charging. The proposed system will combine intelligent estimation, nonlinear control, and modular power architecture to achieve safe, efficient, and grid-sustainable energy transfer—enabling compatibility with diverse EV batteries, direct renewable integration, and continuous operation under large air gaps and misalignments. **Research Context:** While capacitive wireless charging is promising for lightweight, low-cost, and metal-free energy transfer, current designs face limitations in alignment tolerance, variable coupling capacitance, and restricted compatibility with different battery systems. Moreover, most systems rely on direct communication with the vehicle to estimate the state of charge (SOC) and battery voltage, increasing complexity/cost. This research proposes a universal, AI-assisted dynamic capacitive charger capable of estimating SOC and battery voltage from the primary side only, enabling plug-less operation with any EV type. The system will employ L-type couplers for extended air gaps (≥300mm), adaptive frequency tuning, and an estimator-based nonlinear controller that maintains efficiency and safety even under varying environmental and loading conditions. Integration with renewable sources (PV/wind) and embedded Power Factor Correction (PFC) will allow seamless operation within smart grids and off-grid systems alike. **Objectives:** • **O1.** Design a modular and scalable L-type capacitive coupler architecture optimised for dynamic charging, large air gaps, and varying dielectric environments. • **O2.** Develop an estimator-based nonlinear control framework capable of primary-side SOC and battery voltage estimation using AI-enhanced observers and reinforcement learning adaptation. • **O3.** Integrate adaptive frequency tuning and compensation to sustain resonance and maximum power transfer under dynamic conditions, using AI to predict and correct for coupling variations.		

	• **O4.** Embed PFC at the input stage and enable direct DC coupling to PV arrays, allowing green energy utilisation and grid-friendly operation with reduced harmonics. • **O5.** Implement a prototype (5–20 kW) dynamic C-WPT system and experimentally validate efficiency (>97%), safety (IEEE-C95.1-compliance), and interoperability across different EV platforms. **Methodology:** The project will adopt a hybrid approach combining analytical modelling, AI optimisation, and hardware prototyping: 1. **System Modelling:** Develop high-frequency equivalent and field-coupled models in MATLAB/Simulink and ANSYS/Maxwell to study L-type couplers and frequency-tuned compensation. 2. **AI-Assisted Nonlinear Control:** Implement an estimator-based controller with adaptive observers for SOC and voltage estimation, trained using reinforcement learning for real-time optimisation. 3. **Hardware Implementation:** Build a modular C-WPT prototype using wide-bandgap GaN inverters, PFC-enabled front-end, and a DSP/FPGA platform for real-time adaptive control. 4. **Validation:** Perform static and dynamic tests under misalignment, variable dielectric, and load conditions, comparing AI-assisted control with classical methods for robustness, safety, and efficiency. **Potential Impact:** This project will define the blueprint for next-generation, AI-assisted wireless charging infrastructure — a universal platform capable of charging any EV, anywhere, using clean energy. The proposed technology eliminates the need for plug-in charging, supports vehicle-to-grid (V2G) and vehicle-to-vehicle (V2V) energy exchange, and enhances safety through intelligent field regulation. The outcomes will directly support the UK's Net-Zero 2050 goals, contribute to smart city electrification, and position the University of Greenwich as a global leader in next-generation capacitive wireless power systems. This scholarship is awarded competitively, and all applications are carefully reviewed. While we cannot guarantee an offer, we encourage strong candidates to apply.
Duration:	3 years, Full-Time Study or 6 years, Part-Time Study
Support available (subject to satisfactory performance): A successful Home candidate will receive:	

• A Full tuition fee waiver at the university Home-student rate for the specified duration of the scholarship A successful International candidate will receive: • A tuition fee waiver for 50% of the International-student rate for the specified duration of the scholarship. Tuition fees are subject to annual increases. This scholarship does not include funding for living expenses.	
Person Specification of Essential (E) or Desirable (D) requirements:	
Criteria:	**E or D**
Education and Training:	
• 1st Class or 2nd class, First Division (Upper Second Class) honours degree or a taught master's degree with a minimum average of 60% in all areas of assessment (UK or UK equivalent) in a relevant area to the proposed research project	**E**
• For those whose first language is not English and/or if from a country where English is not the majority spoken language (as recognised by the UKBA), a language proficiency score of at least IELTS 6.5 (in all elements of the test) or an equivalent UK VISA and Immigration secure English Language Test is required, if your programme falls within the faculty of Engineering and Science a language proficiency score of at least IELTS 6.5 overall with a minimum of 6.0 in all elements of the test or an equivalent UK VISA and Immigration secure English Language Test is required. Unless the degree above was taught in English **and** obtained in a majority English speaking country, e.g. UK, USA, Australia, New Zealand, etc, as recognised by the UKBA.	**E**
Experience & Skills:	
• Previous experience of undertaking research (e.g. undergraduate or taught master's dissertation)	**E**
• **Power Electronics and High-Frequency Converter Design:** Applicants should have a strong background in power electronics, including resonant converters, inverters, and high-frequency switching systems. Experience with simulation tools such as MATLAB/Simulink, PLECS, or PSIM and a solid understanding of passive components and losses is essential.	**E**
• **Control Systems and Embedded Implementation:** The candidate should have experience in control theory, particularly nonlinear or adaptive control, with practical exposure to DSP- or FPGA-based implementation. Familiarity with real-time control, signal conditioning, and hardware-in-the-loop (HiL) testing will be a strong advantage.	**E**

• **AI / Data-Driven Modelling for Engineering Systems** Applicants should demonstrate experience or strong interest in applying AI or machine learning techniques (e.g. observers, regression, reinforcement learning) to engineering problems. Prior work involving system identification, estimation, or data-driven optimisation in energy or electrical systems is highly desirable.	**D**
Personal Attributes:	
• Understands the fundamental differences between a taught degree and a research degree in terms of approach and personal discipline/motivation	**E**
• Able to, under guidance, complete independent work successfully	**E**
Other Requirements:	
• This scholarship may require Academic Technology Approval Scheme approval for the successful candidate if from outside of the EU/EEA	**E**
• The scholarship must commence before 15th July 2026 (offers will be withdrawn if this condition is not met)	**E**
Closing date for applications:	***midnight UTC on 20th February 2026***
For further information contact:	***m.salimi@gre.ac.uk***

Making an application:

Please read this information before making an application. Information on the application process is available at: https://www.gre.ac.uk/research/study/apply/application-process. Applications need to be made online via this link. **No other form of application will be considered**.

All applications **must include** the following information. **Applications not containing these documents will not be considered.**

- **Scholarship Reference Number (*insert reference*)**– included in the personal statement section together with your personal statement as to why you are applying
- **a CV including 2 referees** *
- **academic qualification certificates/transcripts and IELTs/English Language certificate if you are an international applicant or if English is not your first language or you are from a country where English is not the majority spoken language as defined by the UK Border Agency** *

**upload to the qualification section of the application form. Attachments must be a PDF format.*

Before submitting your application, you are encouraged to liaise with the Lead Supervisor on the details above.